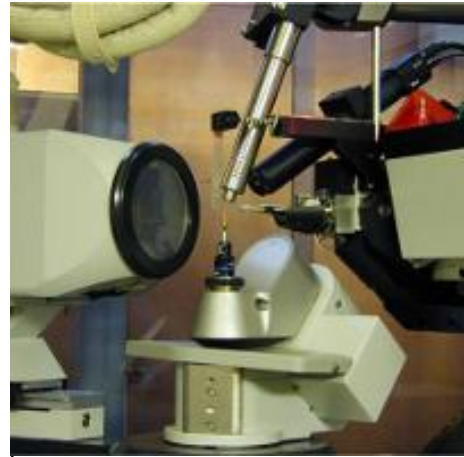


The nano-X platform is a tool dedicated to the characterization of nanomaterials using X-ray scattering and diffraction techniques. The platform is accessible to physicists, chemists, materials scientists and industrial partners. This project was initiated in 2013 and is supported by 4 laboratories based in Toulouse (CEMES, CIRIMAT, LCC and LPCNO). The nano-X platform is geographically based in the 4 constituting laboratories, who aim to maintain and develop X-ray techniques at a competitive level.



*View of the Kappa CCD diffractometer dedicated to single crystal analysis*

The instrument pool is constituted of 7 equipments dedicated to X-ray diffraction and scattering techniques. Two additional equipments will be purchased in a close future. The equipments available allow the analysis of single crystal specimen, polycrystalline bulk sample, thin films and multi layers, as well as powders or amorphous materials, under variable condition of temperature, pressure and atmosphere.

## Partners

The nano-X project is co-funded by

- The [labex NEXT](#)
- [Université Fédérale Toulouse Midi-Pyrénées](#)
- [Université Paul Sabatier](#)

# Service and equipments of the nano-X platform

## Service and domains of expertise

### Single crystal specimen

- Crystal structure determination: selection and mounting of the crystal, optimized data acquisition, data treatment, structure determination and refinement, publication of a CIF file

### Polycrystalline sample

- Qualitative analysis in standard conditions
- Quantitative analysis using Rietveld refinement methods
- High temperature measurements (up to 1200°C)
- Measurements under aggressive atmosphere (H<sub>2</sub>, CO,...)
- Strain and texture determination

### Thin films

- Layer thickness measurement
- Epitaxy conditions determination
- Strain measurements
- Reciprocal space mapping

### Amorphous materials and nanoparticles

- Wide angle X-ray scattering (WAXS) for structural analysis using the Pair Distribution Function approach
- Small angle X-ray scattering (SAXS) to analyse the morphology and/or assembling of nano-objects

## Equipments

The equipments of the nano-X platform are distributed in the different partners sites as follow:

### Laboratoire de chimie de coordination

Contact : Laure Vendier ([laure.vendier@lcc-toulouse.fr](mailto:laure.vendier@lcc-toulouse.fr))

- Diffractometer Nonius equipped with a four circle goniometer (kappa geometry), a CCD BRUKER APEX II camera, and a Mo X-ray sealed tube. It is accompanied with a low temperature measurement system using liquid nitrogen: Cryostream (Oxford Cryosystem) allowing to reach 100 K.

### Centre Interuniversitaire de Recherche et Ingénierie des Matériaux

Contact : Benoît Malard ([Benoit.malard@ensiacet.fr](mailto:Benoit.malard@ensiacet.fr))

- Diffractometer Bruker D8 Advance  
Source : anticathode Cu, programmable divergence slits, 1D detector Vantec. Sample charger (9 positions). A high temperature chamber is available (up to 1200°C)

### Laboratoire de physique chimie des nano-objets

Contact : Guillaume Viau ([gviau@insa-toulouse.fr](mailto:gviau@insa-toulouse.fr))

- Diffractometer Panalytical Empyrean  
Source : anticathode Co, programmable divergence slits, Bragg-Brentano or Debye-Sherrer geometry, point detector or linear detector Xcelerator, high temperature measurements (up to 1200°C), possibility to measure air-sensitive specimen, spinner.  
For thin film applications, hybrid primary optics (mirror + channel-cut Ge 220 monochromator), chi-phi-z stage
- Diffractomètre Panalytical Empyrean  
Source : anticathode Co, primary optic Bragg Brentano HD, linear detector PiXcel, possibility to measure under aggressive atmosphere (H<sub>2</sub>, CO)

### Centre d'élaboration de matériaux et d'études structurales

Contact : Nicolas ratel-Ramond ([nicolas.ratel-ramond@cemes.fr](mailto:nicolas.ratel-ramond@cemes.fr))

- Diffractometer Bruker D8 Advance  
Source : anticathode Cu, primary optics : monocab to define a 100µm beam size, XYZ sample positioning stage,, linear detector Lynxeye Lynxeye,
- Diffractometer Bruker D8 Discover dedicated to strain and texture determination  
Source : microsource Co, collimator set in order to define a beam size between 50 and 500µm, Chi-phi-XYZ sample positioning stage, 2D detector Vantec 500
- Wide angle X-Ray scattering measurement device  
Source : anticathode Mo, Debye Sherrer geometry, SDD detector with high energy resolution allowing a combined X-ray fluorescence analysis.

### Future acquisitions

The nano-X platforms has planned the acquisition of two additional equipments:

- Small Angle X-ray scattering device, equipped with a large sample chamber allowing a versatile use in order to address the needs expressed by the scientific community
- Single crystal X-ray diffractometer equipped with two microsources and a CMOS detector. It will be equipped with a with a low temperature measurement system using liquid helium.